

Academic Year: ( 2020 / 2021 )

Review date: 10-07-2020

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: FERNANDEZ HERRERO, CRISTINA

Type: Electives ECTS Credits : 6.0

Year : Semester :

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electronics Engineering Fundamentals  
Industrial Electronics

## OBJECTIVES

The aim of this course is to provide students with a basic knowledge of digital systems applied to the control electrical power processing. To achieve this objective, students will acquire the following abilities:

- Understand the basic principles of operation of digital logic circuits and digital systems based on microprocessors, microcontrollers and DSP.
- Learn and use the design methodology and use of basic design tools for the development of digital systems
- Analyze and evaluate digital systems applied to the control of electrical power systems.

## DESCRIPTION OF CONTENTS: PROGRAMME

### 1. INTRODUCTION

- 1.1 Course organization
- 1.2. Introduction to digital systems applied to Electrical Engineering
  - 1.2.1. Digital systems in electrical power systems management
  - 1.2.2 Digital control for power systems, power converters and electrical machines

### 2. DIGITAL SYSTEMS I

#### 2.1. COMBINATIONAL SYSTEMS

- 2.1.1. Combinational Logic (review). Number systems and information coding
- 2.1.2. Combinational circuits
- 2.1.3. Design of combinational circuits
- 2.1.4. Binary arithmetic
- 2.1.5. Arithmetic combinational circuits

#### 2.2. SYNCHRONOUS SEQUENTIAL CIRCUITS

- 2.2.1. Registers and counters
- 2.2.2. Introduction to Finite State Machines

### 3. DIGITAL SYSTEMS II

#### 3.1 DIGITAL SYSTEMS BASED ON MICROCONTROLLER and MICROPROCESSORS

- 3.1.1. Architecture and main elements, memory
- 3.1.2 Programming model
- 3.1.3 Introduction to C language

#### 3.2 REFERENCE MICROCONTROLLER

- 3.2.1 Architecture overview
- 3.2.2. Development environment
- 3.2.3. Peripherals
- 3.2.4. Interrupts

## LEARNING ACTIVITIES AND METHODOLOGY

- Lectures oriented to introduce Power Electronics concepts.
- Lectures oriented to problems resolution.
- Laboratory.

## ASSESSMENT SYSTEM

The evaluation of the subject is based on reports containing the solution to exercises based on the activities developed during the classes, and an end of term exam.

The content of the reports is the following:

- Report 1: design, implementation and characterization of a digital system based on an FPGA.
- Report 2: design, implementation and characterization of a digital system based on a microcontroller.

The final grade of the subject will be calculated as follows:

- Option A:  $0.4 \cdot \text{Report1} + 0.6 \cdot \text{Report2}$
- Option B:  $0.4 \cdot (\text{Reports}) + 0.6 \cdot \text{Exam}$

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

## BASIC BIBLIOGRAPHY

- Thomas L. Floyd Digital fundamentals, Pearson Prentice Hall.
- [www.energia.nu](http://www.energia.nu) Get started with Energia, URL.

## ADDITIONAL BIBLIOGRAPHY

- KUO, BENJAMIN C. "Digital Control Systems ", Oxford University Press, USA; 2 edition (June 1995).
- Luca Corradini, Dragan Maksimović, Paolo Mattavelli, Regan Zane Digital Control of High-Frequency Switched-Mode Power Converters, Wiley-IEEE Press, 2015
- Simone Buso, Paolo Mattavelli "Digital Control in Power Electronics Book Description", Morgan & Claypool.